

Amendments to the Drawings

The replacement sheet of drawings attached hereto as **Exhibit A** include changes to, and replace, Figure 1 of the original sheets of drawings. Textual labels have been added to elements 102, 103 and 105-112 in Figure 1.

Attachment: replacement sheet of drawings for Figure 1

REMARKS

The application has been reviewed in light of the Office Action dated November 17, 2006. Claims 1-13. By this Amendment, claims 6, 7 and 9-11 have been amended to remove multi-dependencies therein, claims 1-9 and 11-13 have been amended to clarify the claimed subject matter without narrowing a scope thereof. Accordingly, claims 1-13 are presented for reconsideration, with claim 1 being in independent form.

The drawings were objected to as having informalities.

The replacement sheet of drawings attached hereto as **Exhibit A** include changes to, and replace, Figure 1 of the original sheets of drawings. Textual labels have been added, in accordance with the Examiner's suggestion, to elements 102, 103 and 105-112 in Figure 1.

Withdrawal of the objection to the drawings is respectfully requested.

Claims 8-10, 12 and 13 were objected to under 37 C.F.R. 1.75(c) as purportedly in improper form.

By this Amendment, claims 6, 7 and 9-11 have been amended to remove multi-dependencies therein.

Withdrawal of the objection to the claims is respectfully requested.

Claims 1-13 were rejected under 35 U.S.C. § 102(b) as purportedly anticipated by U.S. Patent No. 6,307,368 to Vasanawala et al.

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claim 1 is patentable over the cited art, for at least the following reasons.

This application relates to a magnetic resonance imaging (MRI) apparatus that does not require presaturation or special control of gradient magnetic field pulse and enables effective selection of a field of view, by performing specific irradiation phase control for the

RF magnetic field. Such an approach is discussed in the specification at page 16. RF transmitting coils apply the RF field with the same phases for the first half of the irradiation time of the RF pulse, and for the second half, the RF transmission should be performed with a phase changed by 180° from the phase of the first half of the RF pulse waveform. Independent claim 1 addresses these features, as well as additional features.

Vasanawala, as understood by Applicant, proposes a spectrally-selective, steady-state free precession (SSFP) technique in MR imaging. In the SSFO technique proposed by Vasanawala, selected sequences of RF excitation pulses are applied which produce an equilibrium magnetization that fluctuates between several values, thus permitting simultaneous acquisition of several images with different contrast features. For example, fat and water images can be acquired, and the relative contribution of the T_1 and T_2 , relaxation mechanisms to image contrast are controlled by adjusting the flip angle.

Vasanawala, Figures 4a, 4b, 16a, 23a and 31b were cited in the Office Action as purportedly showing pulse waveforms where the phase of the first half is opposite of or 180° out of phase from the second half of the RF pulse waveform.

Applicant disagrees. Vasanawala, Figures 4a, 4b, 16a, 23a and 31b do not show RF pulses. Instead, Vasanawala clearly indicates that Figures 4a, 4b, 16a, 23a and 31b show the off-resonance characteristics of the transverse magnetization, that is, the characteristics of the response to the excitation pulses.

For example, the Brief Description Of The Drawings section of Vasanawala states in relevant part as follows:

FIG. 4A illustrates SSFP equilibrium transverse magnetization and FIG. 4B illustrates phase for a species with T_1 of 900 ms and T_2 of 200 ms ($TR=2.5$ ms).

...

FIGS. 16A, 16B, 16C illustrate equilibrium transverse magnetization versus off-resonance.

...
FIGS. 23A, 23B, 23C illustrate experimental off-resonance behavior of SSFP and FEMR sequences.

...
FIGS. 31A, 31B illustrate magnitude spectral response and real signal for a 0-90 FEMR sequence.

Further, Vasanaawala, column 5, lines 7-8, states: "... Note that the plots in FIG. 4 show but one cycle of periodic responses; ..." Vasanaawala, column 11, lines 42-44, states: "FIG. 16 shows equilibrium transverse magnetization versus off-resonance for species with T_1 of 170 ms and T_2 of 40 ms." Vasanaawala, column 13, lines 58-61, states: "FIG. 23 shows experimental determination of off-resonance behavior of SSFP and 0°-90°. FEMR sequences with a TR of 3.3 ms."

It is also clear from reviewing Figs 4a and 4b that they refer to responsive characteristics from the fact that the transversal axis corresponds to off-resonance frequency.

Vasanaawala simply does not teach or suggest, however, of a magnetic resonance imaging apparatus comprising RF transmitting means for applying an RF magnetic field to a subject placed in a static magnetic field, an RF irradiation control means for controlling irradiation phase of the RF magnetic field, wherein the RF irradiation control means controls RF irradiation so that the RF pulse should be applied with a phase of the second half of the RF pulse waveform after the temporal center thereof different by 180 degree from the phase of the first half of the RF pulse waveform, as provided by the subject matter of claim 1.

Accordingly, for at least the above-stated reasons, Applicant respectfully submits that independent claim 1 and the claims depending therefrom, is patentable over the cited art.

Further, in section 8 of the Office Action, element 14 is equated with the RF transmitting coil of claim 2 of the present application.


However, element 14 in Vasanawala is a gradient magnetic field coil, and not the RF transmitting means, in the claims of the present application, for applying an excitation RF pulse.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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